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NUMBER 1

ECOLOGY OF WALLEYES IN RICHARSON LAKE — LAKE ATHABASCA

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ECOLOGY OF WALLEYES IN RICHARDSON LAKE-LAKE ATHABASCA

1967

B. F. Bidgood
Fisheries Research Biologist

Report submitted: January, 1968

ABSTRACT

As a result of investigations conducted in May of 1965 and 1966, a commercial fishery for walleyes in Richardson Lake was closed in 1967. A commercial fishery prescribed for the same species in Lake Athabasca continued in 1967. Information gathered in the 1967 investigations on Richardson Lake indicated that walleyes were homing to and spawning in the Maybelle River, a tributary of Richardson Lake. Water temperature data and maturity and sex ratio data on walleyes indicated that these fish were entering the Richardson Lake area in the spring when the lake was still under ice. Returns from walleyes tagged in the Richardson Lake area indicated that the Lake Athabasca commercial fishery was harvesting a portion of the Richardson Lake spawning population.

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INTRODUCTION

Richardson Lake (108-07-W4) is located about seventeen miles (27 km.) southwest of Lake Athabasca and drains through the delta of the Athabasca River into Lake Athabasca (Figure 1). A commercial gill net fishery for yellow walleyes, Stizostedion vitreum vitreum (Mitchill), has operated on the lake during the latter part of May and early June from 1962 to 1966 inclusive. Each year the Richardson Lake fishery has preceded a commercial fishery for the same species in the dystrophic waters at the western end of Lake Athabasca. After the walleye fishery, the commercial fishermen have moved east to Crackingstone Point in the Saskatchewan portion of Lake Athabasca (Figure 5). Here they have harvested the populations of lake trout, Salvelinus namaycush (Walbaum), and lake whitefish, Coregonus clupeaformis (Mitchill) that inhabit the oligotrophic portion of the lake.

Bidgood (MS 1965), in a study of the movement of walleyes into Richardson Lake, concluded that the commercial nets were harvesting an emigration of spawning walleyes. The commercial catch comprised mainly male fish. Rawson (1956) found that male walleyes preceded females in the spawning run from Lac La Ronge, Saskatchewan, remained on the spawning site after the spent females had left and in total outnumbered females in the run. In the 1966 Richardson Lake spring fishery, Bidgood (MS 1966) found an increased proportion of female fish in the commercial catch. Consequently, the fishery in Richardson Lake was closed in 1967.

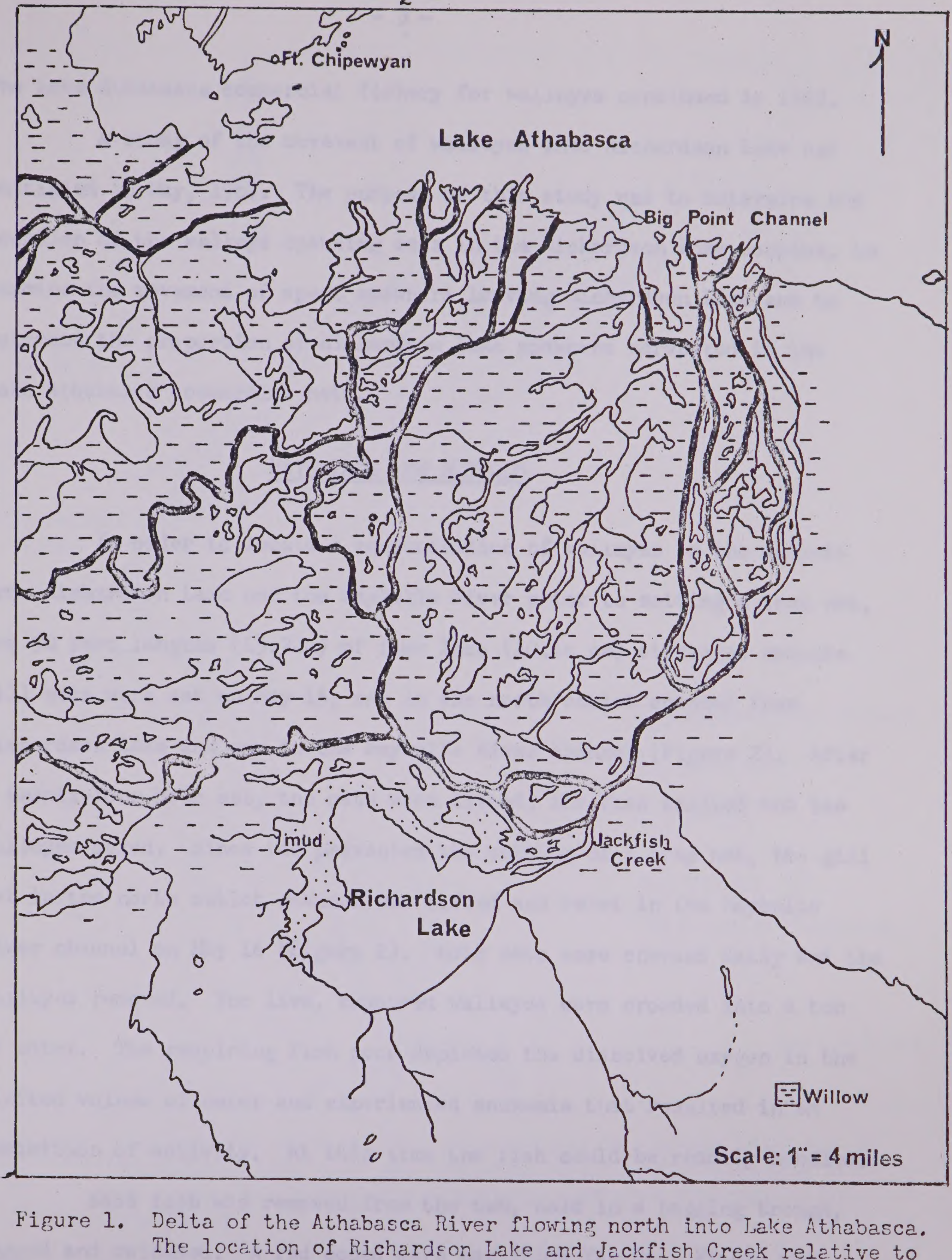

Figure 1. Delta of the Athabasca River flowing north into Lake Athabasca. The location of Richardson Lake and Jackfish Creek relative to the main channels of the Athabasca River (shaded) are indicated.

The Lake Athabasca commercial fishery for walleyes continued in 1967.

A study of the movement of walleyes into Richardson Lake was initiated in May, 1967. The purpose of this study was to determine the location of the walleye spawning beds in the Richardson Lake complex, to examine the movement of spent spawners leaving Richardson Lake and to estimate the proportion of Richardson Lake spawners harvested in the Lake Athabasca commercial nets.

MATERIALS AND METHODS

In order to locate a concentration of walleyes in the outlets from Richardson Lake and the Maybelle River prior to setting a trap net, two 50 yard lengths (45.72m) of four inch (10.16 cm) stretched measure gill nets were set on May 15, one in the north outlet channel from Richardson Lake and one in the Maybelle River channel (Figure 2). After a twenty-four hour set, the nets were lifted, the fish tallied and the walleyes sexed. Since ice prevented the setting of a trap net, the gill net in the north outlet channel was lifted and reset in the Maybelle River channel on May 16 (Figure 2). Both nets were checked daily and the walleyes removed. The live, captured walleyes were crowded into a tub of water. The respiring fish soon depleted the dissolved oxygen in the limited volume of water and experienced anoxemia that resulted in an inhibition of activity. At this time the fish could be readily handled.

Each fish was removed from the tub, held in a tagging trough, tagged and released. A red coded dart tag (Floy Tag Co., FT-6A) was used. The double-barbed tag was inserted into a tag applicator (Figure 3) with one of the barbs protruding. The applicator was marked to indicate

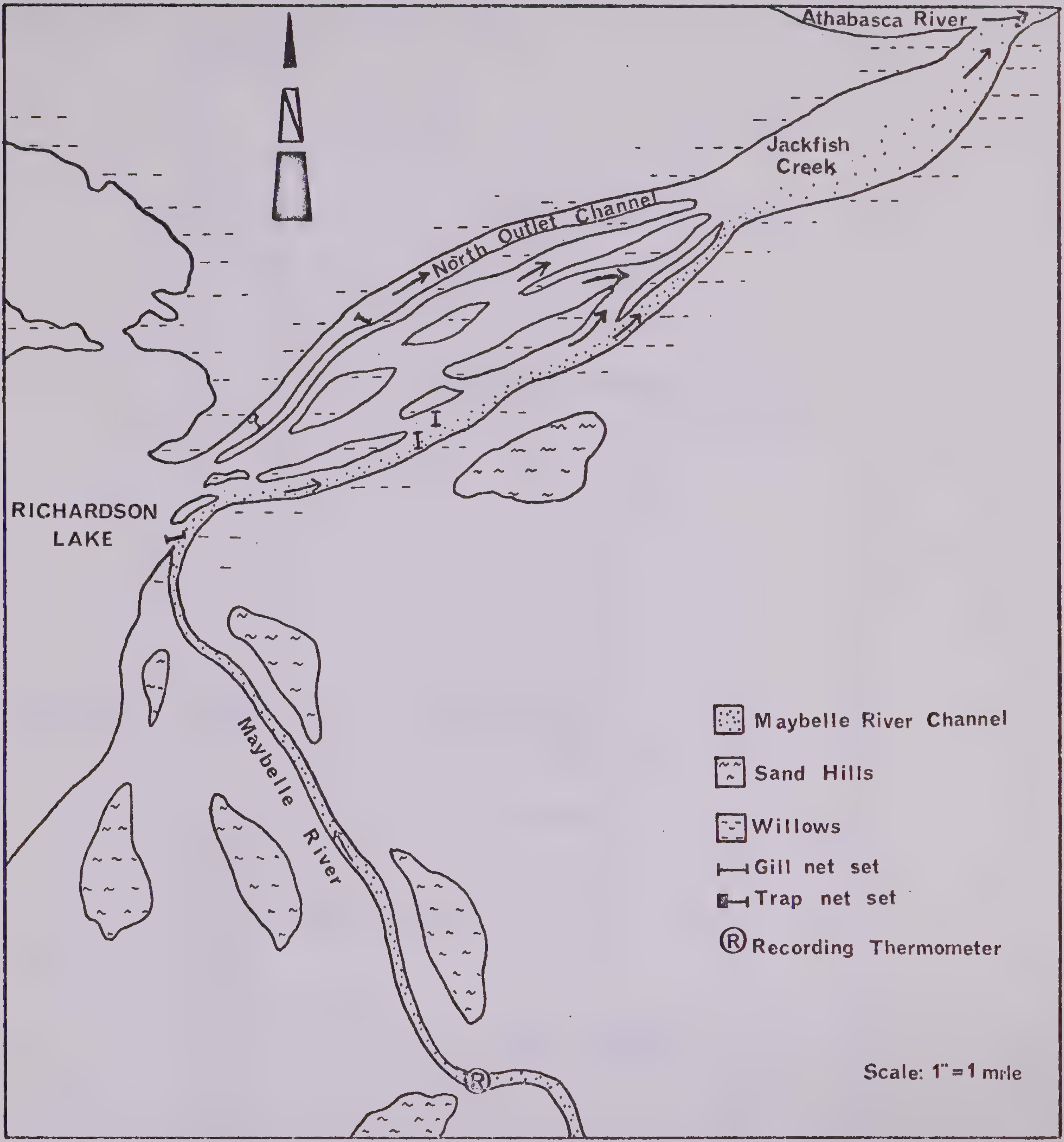

Figure 2. Drainage of the Maybelle River through the outlet channels of Richardson Lake into the Athabasca River. The locations of gill net sets, the trap net set and the recording thermometer are indicated.

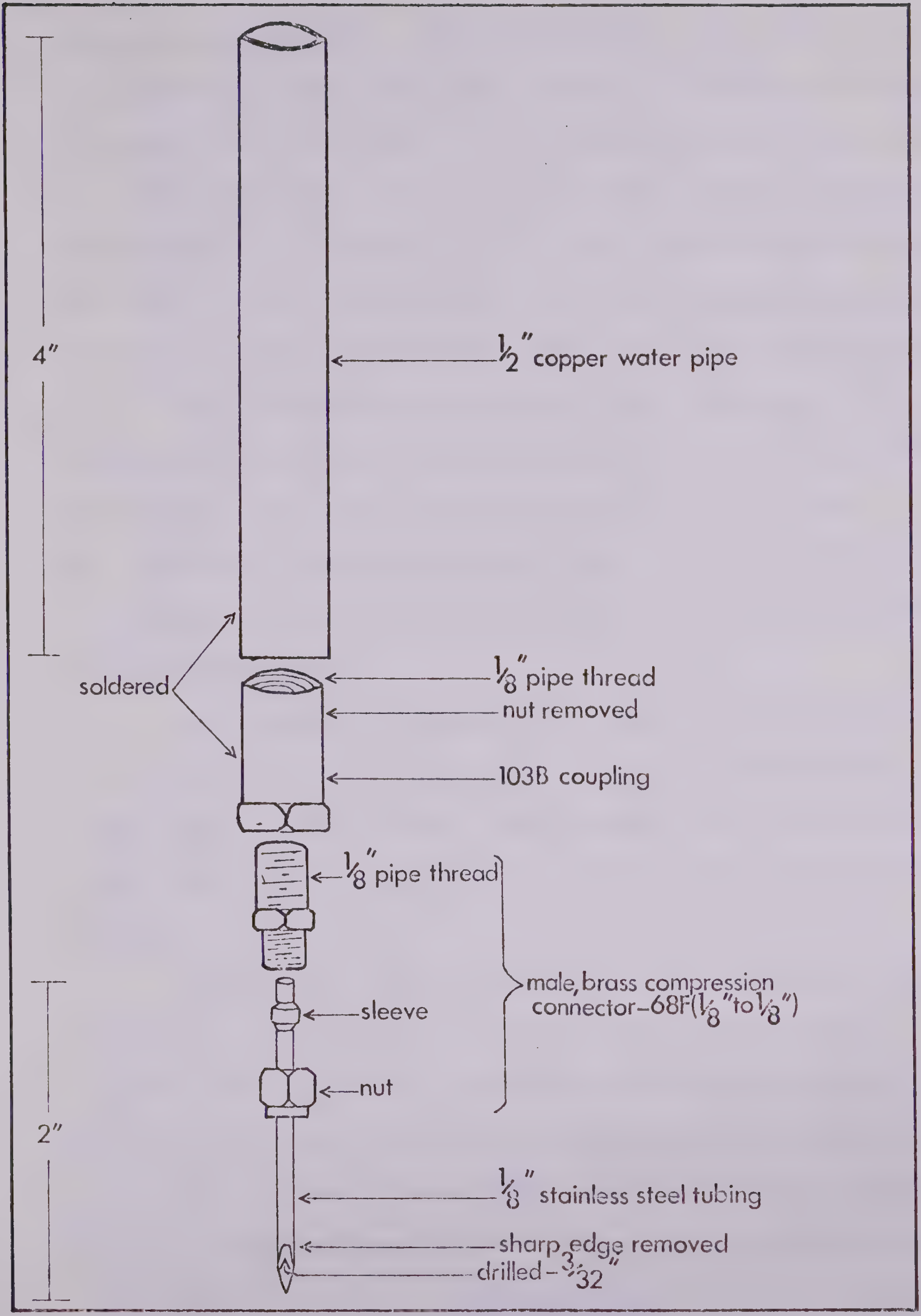

Figure 3. Diagram of the applicator employed in the tagging of Walleyes. The dart tag is inserted in the end of the stainless steel tubing with one of the barbs protruding.

the position of the barbs. Several applicators were loaded with tags and immersed in a two per cent Lysol solution in readiness for tagging. On tagging, the loaded applicator was inserted parallel to and between the scales to the right side of the spiny dorsal fin to a depth of about three quarters the width of the fish, given a quarter turn and withdrawn. The barbs of the tag remained hooked behind the proximal pterygiophores of the fish. The tag number was recorded before the fish was released.

Water temperatures were recorded with a thermistor on several occasions in the north outlet channel from Richardson Lake and the Maybelle River channel. The time of the reading was noted in each case. On May 16, a continuous recording thermometer was placed in the Maybelle River at a location designated in figure 2. Water temperatures were continuously recorded until May 25.

Ice prevented the setting of an eight foot (2.44m) trap net in the Maybelle River. The trap net with a 50 yard (45.72m) lead was set across the north outlet channel from Richardson Lake on May 23 (Figure 2). Daily, until May 27, all walleyes captured in the crib were tagged and released.

On May 26, 50 yards of 4 inch (10.16 cm) stretched measure gill net was set in the first access point from the Maybelle River to Richardson Lake (Figure 2). The following day the net was lifted, the captured fish tallied and the sex and maturity of the walleyes noted. On the same day, four 12 foot (3.66m) lengths of four inch gill nets were set in the Maybelle River. These nets were examined and lifted on May 27.

RESULTS AND DISCUSSION

The yields from the simultaneous gill net sets in the Maybelle

River channel and the north outlet channel from Richardson Lake are tabulated in Table 1. More fish of all species, including walleyes, were captured in the Maybelle River channel. These data suggest that the walleyes are using the Maybelle River channel in preference to the north outlet channel from Richardson Lake.

The sex ratio of walleyes captured in the Maybelle River channel is summarized in Table II. Eight per cent of the fish were spent females. The sex ratio and the maturity of the females indicates that the peak of the spawning run had passed.

On May 16, both Richardson Lake and Lake Athabasca were under ice cover. The Maybelle River and the Athabasca River were free of ice at this time. A comparison of water temperatures in the north outlet channel from Richardson Lake, the Maybelle River channel and the Maybelle River is presented in Table III. In all cases the Maybelle River water was warmer than either the Richardson Lake water or the Maybelle River channel water. The colder Richardson Lake water, when mixed with the Maybelle River water (Figure 2) in the Maybelle River channel, lowered the temperature of the water in the channel. Rawson (1956) postulated that the emigration of walleyes from Lac La Ronge, Saskatchewan was motivated by the warmer river water entering the lake. Doonanco[1] noted that the Maybelle River was free of ice on April 23 and a 40 yard (36.58m) length of domestic gill net set at the mouth of Jackfish Creek in the Athabasca River (Figure 2) yielded 47 walleyes at this time. Two of these fish were "green" females. From these observations it would appear that the movement of walleyes into the Richardson Lake area occurs

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[1] J. I. Doonanco,-Regional Fish and Wildlife Officer. Personal correspondence.

TABLE I. Total catch from two simultaneous overnight sets of 50 yards of gill net in the north outlet channel from Richardson Lake and the Maybelle River channel. The locations of the sets are designated in figure 2.

LOCATION	SPECIES Yellow walleyes	Lake whitefish	Northern pike	Longnose sucker	White sucker
North outlet channel	7	1	19	1	0
Maybelle River channel	52	14	46	4	1

TABLE II. Sex ratio of yellow walleyes captured on two occasions in gill net sets in the outlet channel of the Maybelle River. The location of the sets are designated in figure 2.

Date (1967)	Sample Size	Number Females	Percent Females
May 16	50	4	8
May 23	13	1	7.7

TABLE III. Water temperature recordings from three locations in the outlets from Richardson Lake and the Maybelle River. Comparisons are made of readings taken at the same time of day.

DATE (1967)	WATER TEMPERATURE (°C)		
	North outlet channel	Maybelle River outlet channel	Maybelle River
May 15	1.5	-	5.0
May 20	-	-	6.0*
May 21	-	8.0	10.0*
May 22	-	4.0	9.4*
May 23	-	5.5	9.2*
May 24	6.5	-	9.0*
May 26	9.5	-	-
May 27	9.5	-	-

* From a continuous recording thermometer

considerably earlier than the time that the ice leaves both Richardson Lake and Lake Athabasca. These findings concur with those of Rawson (1956) in his study on Lac La Ronge.

The daily high and low water temperatures in the Maybelle River are presented in Figure 4. Rawson (1956) reported that the main run in the tributaries to Lac La Ronge occurred at water temperatures ranging from 4.4 to 5.6°C and active spawning occurred at 7.8 to 10.0°C. By May 15, the water temperature in the Maybelle River suggests that the main spawning run had passed. By May 23, all females captured in the Maybelle River channel were spent (Table II). On this date, the Maybelle River water temperature was about 9°C.

The simultaneous net sets in the clear water of the Maybelle River Channel and the humic Richardson Lake water in the same channel (Figure 2) yielded 27 and 1 walleyes respectively. This suggests that the walleyes are homing to the Maybelle River water. In calm weather, the clear waters from the Maybelle River extend into Richardson Lake. Normally, under the prevailing northwest winds, the clear water is restricted to the Maybelle River channel as indicated in Figure 2. The walleyes may be entering Richardson Lake through any one of the four outlet channels before spawning or entering the lake after spawning. Loftus[2] stated that walleyes in Ontario avoid light. They spawn during the twilight hours and seek protection from bright light under cover or in turbid waters. Walleyes in the Maybelle River could be seeking overhanging vegetation or undercut banks in the river during the daylight hours or could be moving to Richardson Lake during daylight hours and back to the Maybelle River at dusk.

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[2] K. H. Loftus. Fisheries Res. Sect., Ont. Dept. Lands & Forests, Maple, Personal communications

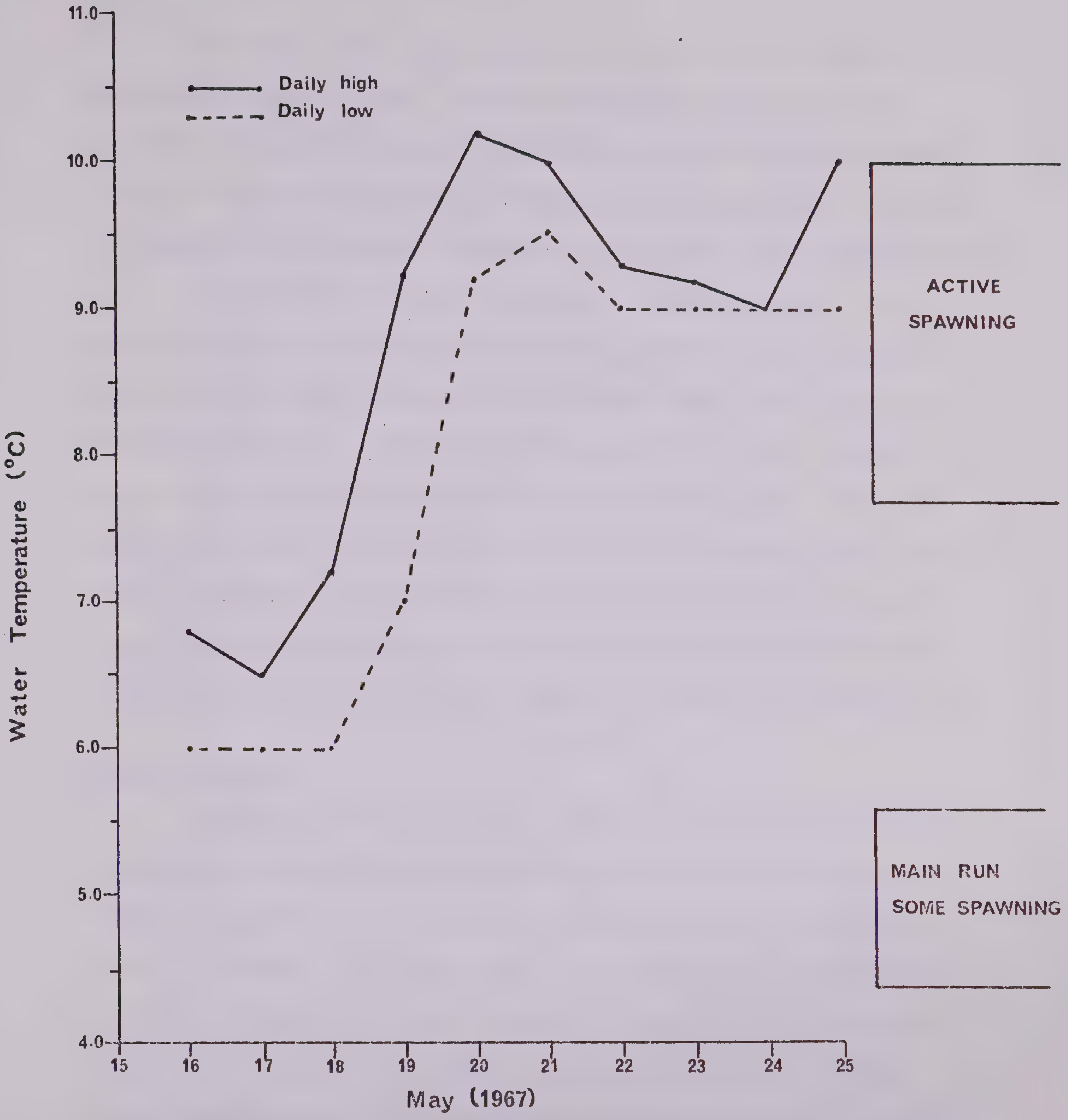

Figure 4. Daily high and low water temperatures in the Maybelle River from May 16 to May 25, 1967 inclusive. The water temperatures noted by Rawson (1956) as stimulating the spawning run and active spawning are indicated.

Overnight sets of short lengths of gill nets in the Maybelle River did not capture fish. The nets were filled with debris when recovered and may have led the migrating fish rather than gilling them. One male walleye was captured by angling in the Maybelle River on May 20. The extent of the movement of walleyes in the river has not been documented.

Turner[3], while engaged in surveys of lakes connected to the Maybelle River system about 20 miles (32 km) upstream from Richardson Lake, found all female walleyes captured between May 25 and June 4, 1967 inclusive to be spent. These observations concur with those gathered near the mouth of the Maybelle River during the same period. The lake survey crew found walleyes present in only five of nineteen lakes surveyed south and southeast of Richardson Lake. All five lakes were connected to the Maybelle River system. The walleye populations in these lakes probably originated from the Lake Athabasca-Athabasca River population.

Tagging Operation

A total of 508 walleyes were captured, tagged and released in the outlet channels from Richardson Lake and the Maybelle River. The number and location of tag recaptures reported in 1967 are summarized in Figure 5. Eighteen, or 3.5 per cent of the fish tagged, were recaptured off Big Point Channel in Lake Athabasca, 20 miles (32.19 km) from the tagging site during the Lake Athabasca commercial fishery. The time elapsed since release in the Richardson Lake area and recapture off Big Point Channel in Lake Athabasca varied from 8 to 26 days. The lake Athabasca commercial fishery for walleyes is harvesting a portion of the Richardson Lake area spawners.

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[3] W. R. Turner. Alberta Fish and Wildlife Division, Edmonton, Personal communications.

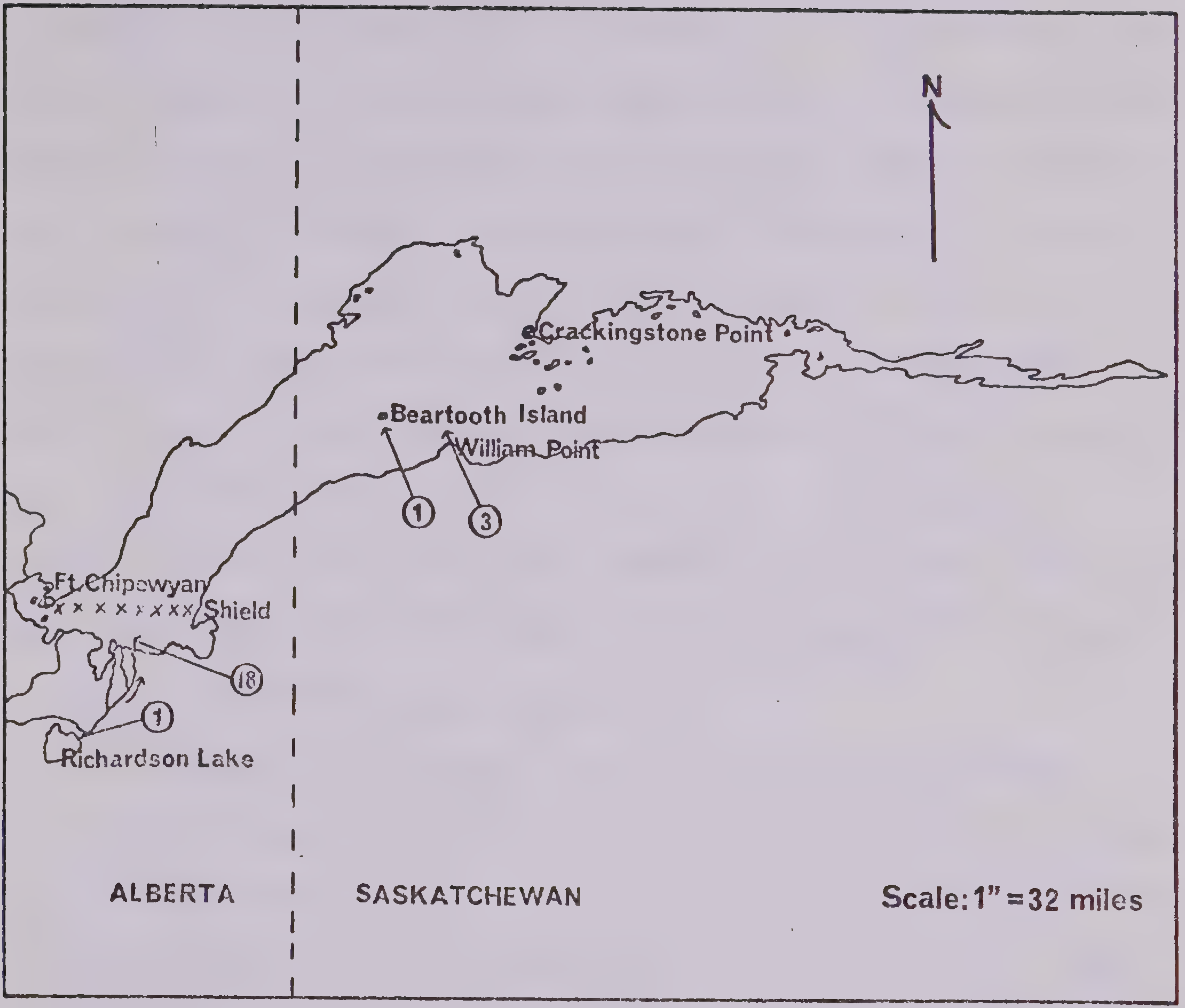

Figure 5. Location of recaptured tagged walleyes in Lake Athabasca. The number of fish recaptured at each location is indicated. The approximate southern boundary of the Canadian Shield is designated.

The fish tagged in the Richardson Lake area were predominantly males (Table II). The majority of the females were spent. The tagging operation (May 21 to 27) captured fish present some time after the peak of spawning activity (Figure 4). The majority of the spawners must have left the area before the tagging operation commenced. The Lake Athabasca commercial fishery operated from May 30 to June 18, 1967 and harvested 125,252 pounds of walleyes. Bidgood (MS 1966) found that in a sample of 94 walleyes the average weight was about two pounds. Therefore the commercial fishery harvested about 62,620 walleyes in the Big Point Channel area. It took tagged walleyes an average of 20 days to reach and be recaptured in the Big Point Channel area. Since the main spawning run had passed when tagging commenced, it is probable that a much higher proportion of Richardson Lake area spawners are harvested in the Lake Athabasca commercial walleye nets.

A total of 22 walleyes, or 4.33 per cent of those tagged, were reported recaptured in the Lake Athabasca nets. Four of the tagged walleyes were caught in commercial nets set in the oligotrophic portion of Lake Athabasca for lake whitefish and lake trout (Figure 5). These fish travelled 74 (119.09 km) to 86 (138.41 km) miles from the tagging location in a maximum period of 94 to 102 days. Walleyes inhabiting the shield portion of Lake Athabasca are probably homing to the Richardson Lake area in the spring to spawn.

Three walleyes recaptured in gill nets 100 to 102 days after being tagged were examined with the dart tags intact. In all cases, the tags were firmly lodged in the fish and the point of insertion had no signs of irritation or infection.

SUMMARY

1. The main spawning run in the Richardson Lake area in 1967 occurred when Richardson Lake and Lake Athabasca were under ice cover but the Maybelle River was free of ice.
2. The Maybelle River channel appears to be the main migration route of the walleye spawning run into the Richardson Lake area.
3. Data gathered to date indicates that the walleyes are spawning in the Maybelle River.
4. Lake Athabasca commercial nets are harvesting walleyes that spawn in the Richardson Lake area.
5. Spawning walleyes tagged in the Richardson Lake area are migrating to the oligotrophic portion of Lake Athabasca.

ACKNOWLEDGEMENTS

I wish to thank the following Officers of the Fish & Wildlife Division for their assistance in both the transportation of equipment and directly in the study: N. E. Thomas, J. E. Allen, G. W. Pollock, A. Kirkwood, and H.E. Schaber. J. I. Doonanco, Regional Fish and Wildlife Officer, is acknowledged for organizing the assistance. The commercial fishermen, operating in conjunction with the McInnes Products Corporation Ltd., Edmonton, are acknowledged for reporting the dates and locations of tag recaptures. R. Schlader placed the fish with tags intact in the hands of the author.

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Rawson, D. S. 1956. The life history and ecology of the yellow walleye, Stizostedion vitreum in Lac La Ronge, Saskatchewan. Trans. Am. Fish. Soc. 86:15-37.

RECOMMENDATIONS

Studies of the ecology of spawning walleyes in the Richardson Lake area should be continued. The extent of the harvest of the Richardson Lake area spawners by the Lake Athabasca commercial nets should be assessed in succeeding years. The extent of repeat spawning should be documented.

The spawning requirements of this fish should be assessed and the movement of the emerging fry determined. The fry could be using Richardson Lake as a nursery for several months. The Peace River Dam in British Columbia could cause an increased drainage from the western end of Lake Athabasca through the Peace River by lowering the volume flow in the river. The drainage of Richardson Lake through the Athabasca River and Big Point Channel could be increased. A reduced volume of water in Richardson Lake may be detrimental to walleye recruitment.

1. Richardson Lake should _not be_ commercially fished.
2. The following research activities should be conducted in May, 1968.
    I. A trap net should be set in Jackfish Creek (Figure A) and the following information gathered.
        a. Record returns of 1967 tagged walleyes (red tag).
        b. Tag unmarked walleyes in run (green tag).
        c. Record date of recapture of green and red tags.
        d. Sample 30 walleyes per day recording:
            i. length, weight
            ii. sex, maturity
            iii. age (scales)
            iv. Occurrence of _Triaenophorus stizostedionis_

- e. Collect lake whitefish and preserve stomachs.
- f. Record abundance of all species of fish caught in the crib daily.

II. A fyke net should be set in the Maybelle River - upstream from the opening to Richardson Lake (Figure A).

- a. Note tagged walleyes in net - movement upstream.
- b. Reverse fyke net once movement upstream is noted - examine downstream migrants for maturity.
- c. Collect lake whitefish stomachs and preserve.

III. Continuous recording thermometers should be placed at the following locations (Figure B):

- a. Richardson Lake
- b. Maybelle River
- c. Jackfish Creek

IV. Two water samples should be gathered at each of the following locations (Figure B)

- a. Athabasca River - upstream from Richardson Lake
- b. Richardson Lake
- c. Maybelle River
- d. Athabasca River downstream from Jackfish Creek (south bank)
- e. Athabasca River (Big Point Channel)

V. The date and location of capture and the color and number of the tag should be noted for tagged walleyes recaptured in the Lake Athabasca commercial nets.

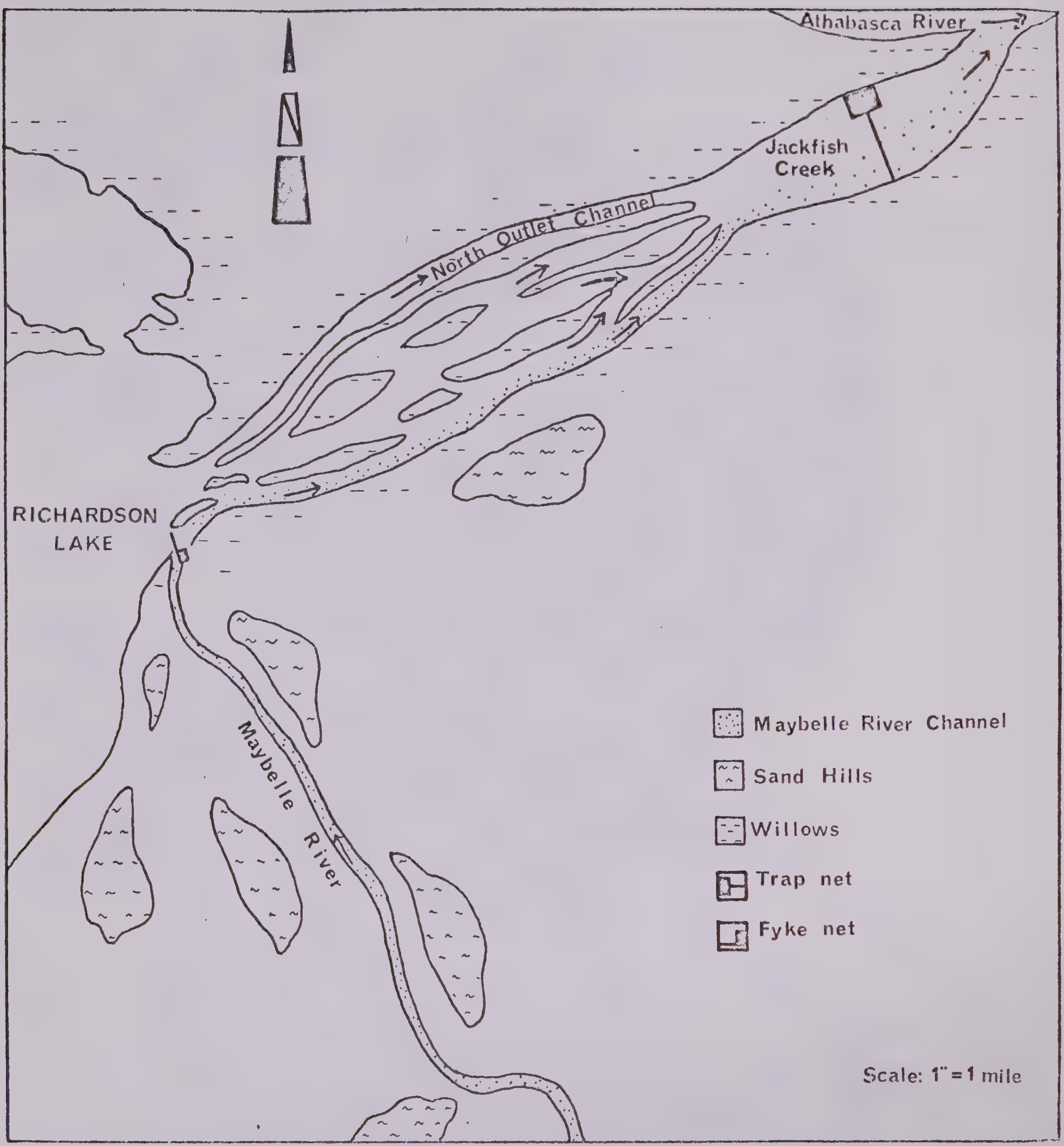

Figure A. Proposed location of the trap net set and fyke net set in the Richardson Lake complex in May, 1968.

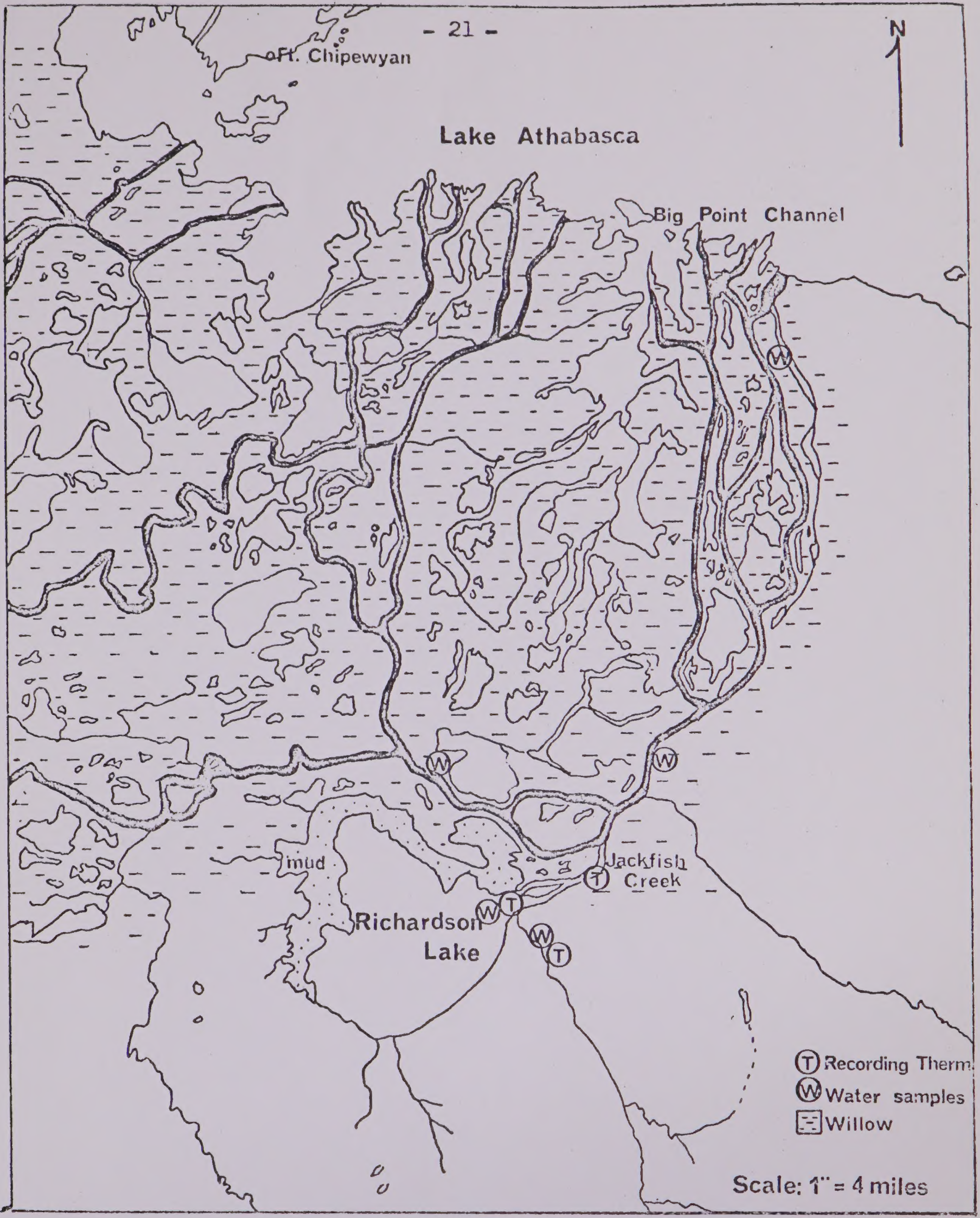

Figure B. Proposed locations of the continuous recording thermometers and water sampling in the Richardson Lake complex in May, 1968.